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NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203			LEE, CHRISTOPHER E	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/775,334	Applicant(s) KIMELMAN ET AL.	
	Examiner Christopher E. Lee	Art Unit 2112	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☒ Claim(s) 18-20 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/10/05</u> | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because a deletion of "[Figure 4]" in line 11 is required. Correction is required. See MPEP § 608.01(b).

Claim Objections

2. Claims 2-11 and 13-20 are objected to because of the following informalities:

In the claims 2-11, substitute "Apparatus" in line 1 by --The apparatus--, respectively.

In the claims 13-20, substitute "A method" in line 1 by --The method--, respectively.

The claim 13 recites the subject matter "said nested interrupt controller" in line 1. However, it has not been specifically clarified in the claim 13 and its intervening claims. Therefore, the Examiner presumes that the term "said nested interrupt controller" could be considered as --said step of controlling- in light of the specification since it is not defined in the claims.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-11 and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claim 1 recites the two different subject matters "a pending interrupt handling program" in line 8 and in line 12, respectively. However, it recalls the subject matter "said pending interrupt handling program" in lines 13-14 and 16-18 without designating which one of the two different subject matters "a pending interrupt handling program." Therefore, it fails to clearly point out which one of the two different subject matters "a pending interrupt handling program" in line 8 and in line 12, is the antecedent basis of

the subject matter "said pending interrupt handling program" in lines 13-14 and 16-18, and then it makes the claim 1 be indefinite.

The Examiner presumes that the term "a pending interrupt handling program" in line 12 could be considered as --said pending interrupt handling program-- in light of the specification since it is not clearly pointed out in the claims. The claims 2-11 are dependent claims of the claim 1.

In the claims 5 and 16, the respective claims recite the two different subject matters "a corresponding interrupt handling program" in line 4 and in line 5, respectively. However, it recalls the subject matter "said corresponding interrupt handling program" in line 6 without designating which one of the two different subject matters "a corresponding interrupt handling program," respectively. Therefore, it fails to clearly point out which one of the two different subject matters "a corresponding interrupt handling program" in line 4 and in line 5, is the antecedent basis of the subject matter "said corresponding interrupt handling program" in line 6, and then it makes the claims 5 and 16 be indefinite, respectively. The Examiner presumes that the limitations "a corresponding interrupt handling program being pending; a corresponding interrupt handling program being active;" in lines 5-6 could be considered as -- a corresponding interrupt handling program being pending or active;-- in light of the specification since it is not clearly pointed out in the respective claims.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1-5 and 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishimoto et al. [US 5,410,715 A; hereinafter Ishimoto] in view of Cox [US 6,081,867 A].

Referring to claim 1, Ishimoto discloses apparatus for processing data (i.e., microcomputer in Fig. 1), said apparatus comprising:

- processing logic (i.e., CPU 2 of Fig. 1) operable to perform processing operations under control of program instructions (e.g., said CPU processing interrupt service routine) and subject to interruption by a plurality of interrupt events (See col. 1, lines 21-30); and
- a nested interrupt controller (i.e., Interrupt Controller 1 of Fig. 1) operable to control nested execution of a plurality of active interrupt handling programs that are started and uncompleted (i.e., interrupt nesting function) and which is responsive to priorities associated with respective ones of said plurality of interrupt handling programs to control pre-emption of one or more active interrupt handling programs (i.e., interrupt processing under execution) by a pending interrupt handling program (i.e., another interrupt request; See col. 1, lines 31-40); wherein
 - said nested interrupt controller (i.e., said Interrupt Controller) is operable:
 - (i) to permit said pending interrupt handling program (i.e., another new interrupt request) to pre-empt a plurality of active interrupt handling programs if a priority associated with said pending interrupt handling program is higher than a highest priority associated with any of said plurality of active interrupt programs (i.e., interrupt nesting function; See col. 1, lines 31-40, and col. 7, lines 60-63, and col. 10, lines 25-28); and

- (ii) to prevent said pending interrupt handling program from pre-empting said plurality of active interrupt handling programs if said priority associated with said pending interrupt handling program is less than said highest priority associated with any of said plurality of active interrupt handling programs (See col. 10, lines 23-24).

Ishimoto does not teach that a priority of a given active interrupt handling program is alterable whilst said given active interrupt handling program is started and uncompleted.

Cox discloses a software configurable technique for prioritizing interrupts (See Abstract and col. 2, lines 47-19), wherein

- a priority of a given active interrupt handling program (i.e., a priority of interrupt) is alterable (i.e., changeable; See col. 3, lines 47-52) whilst said given active interrupt handling program is started and uncompleted (i.e., pending interrupt in configuration registers 100 and vector address registers 200 in Figs. 2A-D; See col. 5, lines 53-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included said software configurable technique for prioritizing interrupts, as disclosed by Cox, in said nested interrupt controller (i.e., Interrupt Controller), as disclosed by Ishimoto, for the advantage of providing more readily configurable interrupts in comparison to prior techniques (See Cox, col. 1, line 61 through col. 2, line 41, and col. 3, lines 33-35).

Referring to claim 2, Ishimoto teaches

- said nested interrupt controller (i.e., Interrupt Controller 1 of Fig. 1) is operable to prevent said pending interrupt handling program from pre-empting said plurality of active interrupt handling programs (i.e., interrupt processing under execution) if said priority associated with said pending interrupt handling program is equal to a highest priority associated with any of said plurality of

active interrupt handling programs (i.e., same priority level; See col. 2, line 65 through col. 3, line 2, wherein in fact that the comparing mean operates to bring the result of comparison into the first level only when the interrupt request generated in the course of execution of the interrupt processing is higher than the priority indicated by the in-service priority information when the information held in the flag is in the first condition clearly implies that said nested interrupt controller is operable to prevent said pending interrupt handling program from pre-empting said plurality of active interrupt handling programs if said priority associated with said pending interrupt handling program is equal to a highest priority associated with any of said plurality of active interrupt handling programs).

Referring to claim 3, Ishimoto teaches

- a priority of an interrupt handling program is set by a programmable priority level associated with said interrupt handling program (See col. 4, lines 60-64).

Referring to claim 4, Ishimoto teaches

- said pending interrupt handling program (i.e., another interrupt request) corresponds to a newly detected interrupt event (See col. 1, lines 31-40).

Referring to claim 5, Ishimoto teaches said nested interrupt controller (i.e., Interrupt Controller 1 of Fig. 1) is responsive to stored values (i.e., interrupting flag in Interrupt Flag 201, and interrupt priority in Interrupt Designation Register 205 in Fig. 2) corresponding to respective ones of a plurality of interrupt events (i.e., Interrupt Requests 3-0...3-7 in Fig. 2) and indicative of:

- a corresponding interrupt handling program being pending or active (i.e., said interrupting flag is set a logic '1', which means "interrupt requesting pending", and reset a logic '0' after receiving

Interrupt Processing Acknowledge Signal 21, which means “interrupt requesting active” in Fig. 2;

See col. 4, lines 45-48 and col. 5, lines 29-35); and

- a priority level (i.e., interrupt priority (0,0)...(1,1) setting in said Interrupt Designation Register (PR0,PR1)) associated with said corresponding interrupt handling program (See col. 4, lines 48-60).

Referring to claim 12. Ishimoto discloses a method of processing data (i.e., a method of controlling interrupt nesting function; See col. 1, lines 63-67), said method comprising the steps of:

- performing processing operations under control of program instructions (e.g., CPU 2 processing interrupt service routine in Fig. 1), said processing operations being subject to interruption by a plurality of interrupt events (See col. 1, lines 21-30); and
- controlling nested execution of a plurality of active interrupt handling programs that are started and uncompleted (i.e., interrupt nesting function by Interrupt Controller 1 in Fig. 1) and in response to priorities associated with respective ones of said plurality of interrupt handling programs to control pre-emption of one or more active interrupt handling programs (i.e., interrupt processing under execution) by a pending interrupt event (i.e., another interrupt request; See col. 1, lines 31-40); wherein
 - said step of controlling (i.e., interrupt nesting function by said Interrupt Controller) is operable:
 - (i) to permit a pending interrupt handling program (i.e., a new interrupt request) to pre-empt a plurality of active interrupt handling programs if a priority associated with said pending interrupt handling program is higher than a highest priority associated with any of said plurality of active interrupt programs (i.e.,

interrupt nesting function; See col. 1, lines 31-40, and col. 7, lines 60-63, and col. 10, lines 25-28); and

- (ii) to prevent said pending interrupt handling program from pre-empting said plurality of active interrupt handling programs if said priority associated with said pending interrupt handling program is less than said highest priority associated with any of said plurality of active interrupt handling programs (See col. 10, lines 23-24).

Ishimoto does not teach that a priority of a given active interrupt handling program is alterable whilst said given active interrupt handling program is started and uncompleted.

Cox discloses a software configurable technique for prioritizing interrupts (See Abstract and col. 2, lines 47-19), wherein

- a priority of a given active interrupt handling program (i.e., a priority of interrupt) is alterable (i.e., changeable; See col. 3, lines 47-52) whilst said given active interrupt handling program is started and uncompleted (i.e., pending interrupt in configuration registers 100 and vector address registers 200 in Figs. 2A-D; See col. 5, lines 53-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included said software configurable technique for prioritizing interrupts, as disclosed by Cox, in said step of controlling (i.e., interrupt nesting function by Interrupt Controller), as disclosed by Ishimoto, for the advantage of providing more readily configurable interrupts in comparison to prior techniques (See Cox, col. 1, line 61 through col. 2, line 41, and col. 3, lines 33-35).

Referring to claim 13. Ishimoto teaches said step of controlling (i.e., interrupt nesting function by Interrupt Controller 1 in Fig. 1) is operable to

- prevent said pending interrupt handling program (i.e., a new interrupt request) from pre-empting said plurality of active interrupt handling programs (i.e., interrupt processing under execution) if said priority associated with said pending interrupt handling program is equal to a highest priority associated with any of said plurality of active interrupt handling programs (i.e., same priority level; See col. 2, line 65 through col. 3, line 2, wherein in fact that the comparing mean operates to bring the result of comparison into the first level only when the interrupt request generated in the course of execution of the interrupt processing is higher than the priority indicated by the in-service priority information when the information held in the flag is in the first condition clearly implies that said nested interrupt controller is operable to prevent said pending interrupt handling program from pre-empting said plurality of active interrupt handling programs if said priority associated with said pending interrupt handling program is equal to a highest priority associated with any of said plurality of active interrupt handling programs).

Referring to claim 14. Ishimoto teaches

- a priority of an interrupt handling program is set by a programmable priority level associated with said interrupt handling program (See col. 4, lines 60-64).

Referring to claim 15. Ishimoto teaches

- said pending interrupt handling program (i.e., another interrupt request) corresponds to a newly detected interrupt event (See col. 1, lines 31-40).

Referring to claim 16. Ishimoto teaches said step of controlling (i.e., interrupt nesting function by Interrupt Controller 1 in Fig. 1) is responsive to stored values (i.e., interrupting flag in Interrupt Flag 201,

and interrupt priority in Interrupt Designation Register 205 in Fig. 2) corresponding to respective ones of a plurality of interrupt events (i.e., Interrupt Requests 3-0...3-7 in Fig. 2) and indicative of:

- a corresponding interrupt handling program being pending or active (i.e., said interrupting flag is set a logic '1', which means "interrupt requesting pending", and reset a logic '0' after receiving Interrupt Processing Acknowledge Signal 21, which means "interrupt requesting active" in Fig. 2; See col. 4, lines 45-48 and col. 5, lines 29-35); and
- a priority level (i.e., interrupt priority (0,0)...(1,1) setting in said Interrupt Designation Register (PR0,PR1)) associated with said corresponding interrupt handling program (See col. 4, lines 48-60).

8. Claims 6, 11, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishimoto [US 5,410,715 A] in view of Cox [US 6,081,867 A] as applied to claims 1-5 and 12-16 above, and further in view of Hedayat et al. [US 5,642,516 A; hereinafter Hedayat].

Referring to claims 6 and 17. Ishimoto, as modified by Cox, discloses all the limitations of the claims 6 and 17, respectively, except that does not teach stack data storage operable to store state data corresponding to processing pre-empted by one or more active interrupt handling programs.

Hedayat discloses a new interrupt implementation using both hardware and software based interrupt processing (See col. 1, lines 5-8), wherein

- stack data storage (i.e., shadow stack registers SH1-3, SH1a-3a, SH1b-3b, etc. for each data register DR1-3 in Fig. 4; See col. 3, lines 43-45) operable to store state data (i.e., contents of data registers, program counter) corresponding to processing pre-empted by one or more active interrupt handling programs (See col. 4, line 59 through col. 5, line 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included said stack data storage (i.e., shadow stack registers), as disclosed by Hedayat, in

said apparatus (i.e., microcomputer), as disclosed by Ishimoto, for the advantage of providing an optimization of interrupt processing speed through the use of shadow registers hardware processing (See Hedayat, col. 5, lines 6-8).

Referring to claim 11, Hedayat teaches

- said stack data storage (i.e., shadow stack registers SH1-3, SH1a-3a, SH1b-3b, etc. for each data register DR1-3 in Fig. 4) is a stack memory (See col. 3, lines 43-45).

Allowable Subject Matter

9. Claims 7-10 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims, and further rewritten or amended to overcome the claim objection under minor informality, set forth in this Office action.

10. Claims 18-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and further rewritten or amended to overcome the claim objection under minor informality, set forth in this Office action.

11. The following is a statement of reasons for the indication of allowable subject matter:

With respect to claims 7 and 18, the claim limitations are deemed allowable over the prior art of record as the prior art fails to teach or suggest that said highest priority level associated with any of said plurality of active interrupt handling programs is increased when free space within said stack data store falls below a predetermined free space level.

The claims 8-10 are dependent claims of the claim 7.

The claims 19-20 are dependent claims of the claim 18.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

With regarding to Nested Interrupt Processing,

Kleiman [US 5,515,538 A] discloses apparatus and method for interrupt handling in a multi-threaded operating system kernel.

Masui et al. [US 5,392,435 A] disclose microcomputer having a system clock frequency that varies in dependence on the number of nested and held interrupts.

Cantrell et al. [US 6,651,126 B1] disclose snapshot arbiter mechanism.

Lebee [US 6,108,744 A] discloses software interrupt mechanism.

Miu et al. [US 4,488,227] disclose program counter stacking method and apparatus for nested subroutines and interrupts.

With regarding to Interrupt Priority Processing,

Bouknecht et al. [US 4,038,642] disclose input/output interface logic for concurrent operations.

Monteiro [US 6,928,502 B2] discloses method and apparatus for processing interrupts at dynamically selectable prioritization levels.

Burns et al. [US 5,958,036 A] disclose circuit for arbitrating interrupts with programmable priority levels.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher E. Lee whose telephone number is 571-272-3637. The examiner can normally be reached on 9:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rehana Perveen can be reached on 571-272-3676. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Christopher E. Lee
Patent Examiner
Art Unit 2112

CEL/

A handwritten signature in black ink, appearing to read "Christopher E. Lee", with a stylized flourish at the end.